

**Amendment and Response Under 37 C.F.R. 1.116**

Applicant: Manfred Ruehrig et al.

Serial No.: 10/509,553

Filed: May 17, 2005

Docket No.: 1433.125.101/13.305

Title: MRAM MEMORY CELL WITH A REFERENCE LAYER AND METHOD FOR FABRICATING

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**REMARKS**

The following remarks are made in response to the Final Office Action mailed September 7, 2006. Claims 18-29 have been withdrawn from consideration. Claims 10-17 were rejected and remain pending in the application, and are presented for reconsideration and allowance.

**Claim Rejections under 35 U.S.C. § 102**

The Examiner rejected claim 10 under 35 U.S.C. § 102(b) as being anticipated by the Anthony et al. U.S. Patent No. 6,172,904. Applicant respectfully submits, however, that the Anthony reference does not teach or suggest the features the claims.

Claim 10 recites a method for fabricating a reference layer for MRAM memory cells. The method includes providing a layer system for the reference layer. The layer system has a first layer of a material having a first Curie temperature. The first layer has a saturation field strength and can be permanently magnetized by an external magnetic field. The layer system has a second layer of a material having a second Curie temperature, which is significantly lower than the first Curie temperature. The second layer can be magnetized by antiferromagnetic coupling with the first layer. The method includes generating an external magnetic field having a field strength and *cooling the layer system from a temperature above the first Curie temperature to below the first Curie temperature by action of the external magnetic field*. The field strength of the external magnetic field is greater than the saturation field strength of the first layer, so that magnetization of the first layer is oriented by a second-order phase transition along the field direction of the external magnetic field. *The layer system is then subsequently cooled below the second Curie temperature and magnetization of the second layer is oriented antiparallel with respect to the magnetization of the first layer on account of antiferromagnetic coupling between the first and second layers*. It is this cooling below these first and second Curie temperatures that is neither taught or suggested in the art of record, and the Examiner does not address how this is shown.

In the Final Office Action, a description is included of the Anthony et al. patent, and specifically the embodiment according to Figure 4 in column 4, lines 19-48. In support of the rejection of claim 10, the Examiner also cites the rejection from the previous Office Action based

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on the embodiment of the Anthony et al. patent depicted in Figure 3 and described in column 3, line 62 to column 4, line 18 of the Anthony et al. patent.

The Anthony et al. patent describes in the embodiment depicted in Figure 4 an antiferromagnetic coupling between the layer 74 of magnetic material and the reference layer 50 through a leery 80 (spacer) for setting the direction of magnetization M1 and the direction of magnetization M4 of the layer 74 of magnetic material is pinned by means of the layer 72 of antiferromagnetic material. However, the Anthony et al. *does not* describe or even suggest that the setting of the direction of magnetization M1 of the reference layer 50 by means of the antiferromagnetic coupling with the layer 74 *is carried out by means of cooling the temperature below a first and second Curie point*, as is described in the embodiment depicted in Figure 3 of the Anthony et al. patent, and recited in claim 10 as highlighted above.

Furthermore, as detailed previously, in view of the fact that the embodiment depicted in Figure 4 of the Anthony et al. patent also needs the *two layers* 70 and 72 of antiferromagnetic material for setting the antiparallel directions of magnetizations, namely M3 and M1 of the additional reference layer 54 and the reference layer 50, respectively, the Anthony et al. patent cannot render obvious nor destroy the novelty of the present claim 10, which has only a single layer. Therefore, Applicants respectfully request reconsideration and withdrawal of the 35 U.S.C. § 102(b) rejection to claim 10, and request allowance of these claims.

**Claim Rejections under 35 U.S.C. § 103**

The Examiner rejected claims 11-17 under 35 U.S.C. § 103(a) as being unpatentable over the Anthony et al. U.S. Patent No. 6,172,904. As these are dependent claims that depend from allowable claim 010 above, they too are in allowable form. Therefore, Applicants respectfully request reconsideration and withdrawal of the 35 U.S.C. § 103(a) rejection to claims 11-17, and request allowance of these claims.

**CONCLUSION**

In view of the above, Applicant respectfully submits that pending claims 10-17 are in form for allowance and are not taught or suggested by the cited references. Therefore,

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reconsideration and withdrawal of the rejections and allowance of claims 10-17 are respectfully requested.

No fees are required under 37 C.F.R. 1.16(b)(c). However, if such fees are required, the Patent Office is hereby authorized to charge Deposit Account No. 50-0471.

The Examiner is invited to contact the Applicant's representative at the below-listed telephone numbers to facilitate prosecution of this application.

Any inquiry regarding this Amendment and Response should be directed to Paul P. Kempf at Telephone No. (612) 767-2502, Facsimile No. (612) 573-2005. In addition, all correspondence should continue to be directed to the following address:

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Respectfully submitted,

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